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Delay of gratification and executive performance in individuals with schizophrenia: Putative role for eating behavior and body weight regulation

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Abstract

Objective: Impairment in executive functions and disturbed weight regulation are common features in individuals with schizophrenia on antipsychotics. Still, the clinical management of weight gain, including educational programs, is insufficient. Therefore, we hypothesized that distinct executive impairment is associated with the inability to self-control food intake.
Method: In the present study we investigated the performance in a paradigm analyzing the executive subfunction "delay of gratification" in individuals with schizophrenia ($n = 29$) compared with controls ($n = 23$) and the interrelationship between delay of gratification, overall executive functioning, reported eating behavior and the BMI.

We applied a board-game paradigm to operationalize delay of gratification: on designated fields individuals need to decide about a small amount of immediate reinforcement versus double the amount in the end. Appetite and eating behavior were assessed by self-report scales, executive functioning by BADS.
Results: We found that the patients performed significantly worse in our paradigm and that this is associated with lower executive functioning. However, the interrelationship between all parameters is complex: there is a significant positive correlation between the reported perceived appetite and executive functioning whereas the reported restrained eating behavior, significantly more frequent in patients, is correlated with low executive functioning and high disinhibition in eating situations.
Conclusions: We conclude that executive functions are necessary to successfully manage eating behavior. Thus, better understanding of the cognitive mechanisms might help to support the patients more efficiently in their tough job to keep control.

Keywords: Schizophrenia; Delay of gratification; Body-weight regulation; Executive functions

1. Introduction

In the last decade neurocognitive impairment in schizophrenia and its clinical implications have increasingly become of greater interest in clinical research (Heinrichs and Zakzanis, 1998). Recent studies further support the view that this is a very early and profound pathology (Hoff et al., 2005). Impaired frontal lobe functions and so called hypofrontality, have become well recognized features in schizophrenia (Andreasen et al., 1986; Davidson and Heinrichs, 2003). Pantelis and colleagues (1997) reported that executive functioning in individuals with schizophrenia is even more disturbed than in patients with substantial frontal lobe damage. These impairments have an important impact on patients' everyday life competence (Green,

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1996) and, in addition, pose a challenge for psychiatric therapy. Velligan et al. (2000) sexamined whether specific neurocognitive deficits predicted specific domains of community outcome in schizophrenic patients. The authors found that executive functioning predicted work performance and activities of daily life.

Executive functions consist of various subfunctions. Anticipation, planning, strategy use, initiation of action and initiation of inhibition, target control as well as task-management have been described as executive components (Mathes-von Cramon and von Cramon, 2000; Smith and Jonides, 1999). These components can be combined to various neuropsychological constructs of higher integrated abilities in order to optimize behavior. Recently, the dichotomy of 'hot' versus 'cold' executive functions was introduced with 'hot' ones affectively loaded and 'cold' ones primarily cognitively operated (Hongwanishkul et al., 2005; Kerr and Zelazo, 2004). Accordingly delay of gratification involves 'hot' executive functioning. This means that an individual is able to resist an immediate reinforcement in favor of a later but greater reinforcement. Delay of gratification comprises the following executive components: anticipation of incoming consequences as well as initiation of inhibition.

Delay of gratification is also discussed in the large body of literature on personality disorders and in personality research with respect to impulsivity (e.g. Cherek et al., 1997; Caci et al., 2003). Recent studies further support its close interrelationship with executive and frontal functioning (e.g. Stuss and Levine, 2002; Spinella, 2004; Cheung et al., 2004). Thus, we suggest that delay of gratification is a neuropsychological paradigm relevant to schizophrenia and associated with the general impairment in frontal functioning in individuals with schizophrenia.

One everyday life aspect is nutritional behavior and weight gain of schizophrenic patients often suffering from obesity (Coodin, 2001). Disturbed weight regulation with increased appetite, obesity and its comorbidity are well known features in individuals with schizophrenia on antipsychotics (Nasrallah and Newcomer, 2004; Nasrallah, 2003). Still, the clinical management of the weight gain is insufficient and mostly educational programs on dieting and control of food intake are inefficient. Antipsychotics have the potential to initiate and facilitate weight gain (Allison and Casey, 2001). However, we assume that the management of increased appetite – be by medication or by other causes – relies on neurocognitive functioning, including delay of gratification. This is already supported by a study in healthy probands (Spinella and Lyke, 2004).

Therefore, we hypothesize that delay of gratification is impaired in individuals with schizophrenia, and that this impairment is associated with poor outcome in overall executive functioning, body weight control and dietary behavior.

Lacking an established tool to operationalize delay of gratification in adults we designed a board game according to published paradigms (e.g. Funder et al., 1983; Mischel and Mischel, 1983; Mischel and Ebbesen, 1970; Olson et al., 1999; Shybut, 1968). Overall executive functioning and dietary behavior were analyzed by established tools. We investigated 29 patients with schizophrenia and compared them to matched healthy controls.

The present study is a pilot study on the impact of distinct neuropsychological functions on eating behavior in schizophrenia.

2. Method

We screened 35 patients who met DSM-IV criteria for schizophrenia. Six patients rejected participation, there were no drop outs, so 29 patients completed (27 patients with paranoid subtype, DSM-IV code: 295.30; 2 patients with desorganized subtype, DSM-IV code: 295.10). Twenty five patients were treated for relapse, four patients were suffering from their first episode. All patients were in stable condition without acute psychotic symptoms and received stable antipsychotic medication. Nine patients received Quetiapine (mean dose 600 mg/d, SD 173.21), eight patients received Risperidone (5.3 mg/d, SD 1.65), six patients received Olanzapine (15.83 mg/d, SD 3.76), four patients received Amisulpride (700 mg/d, SD 115.47), one patient received Flupentixol (10 mg/d) and one patient received Aripiprazol (20 mg/d). Symptoms were measured by the Brief Psychiatric Rating Scale (BPRS).

We screened all patients by medical history. Exclusion criteria for participation in this study were any conditions that prevent the patients from an unrestricted choice of the nutritional reinforcers in the board-game paradigm, such as allergies to one or more of the snack, diabetes or unwillingness to eat at least one of the snacks of choice. In addition, we excluded patients if there was any condition that would not allow correct understanding of all instructions nor correct completing of the board-game paradigm and the self-rating scales, such as insufficient practise in German language or impaired intellectual capacity. Finally, we excluded patients with any additional axis I psychiatric diagnosis.

Twenty three healthy subjects matched for age, sex and educational level were introduced as controls. After complete description of the study to the subjects, written informed consent was obtained. Descriptive characteristics of the samples and statistics for the matching criteria are presented in Table 1. This study was approved by the Ethics Committee at the Medical Faculty of the Christian Albrechts University, Kiel, Germany, and is in accordance with the Declaration of Helsinki.

2.1. Paradigm for delay of gratification

For the assessment of delay of gratification we designed a board game. In terms of amount of the immediate and delayed reinforcement and general design of the board game, we refer to Shybut (1968), Mischel and Ebbesen